

## PATENT COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents  
United States Patent and Trademark  
Office  
Box PCT  
Washington, D.C.20231  
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year)

29 May 2000 (29.05.00)

International application No.

PCT/US99/20649

Applicant's or agent's file reference

82201-PC

International filing date (day/month/year)

10 September 1999 (10.09.99)

Priority date (day/month/year)

10 September 1998 (10.09.98)

Applicant

CHOI, Jong, Uk et al

1. The designated Office is hereby notified of its election made:



in the demand filed with the International Preliminary Examining Authority on:

07 April 2000 (07.04.00)



in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO  
34, chemin des Colombettes  
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

Olivia RANAIVOJAONA

Telephone No.: (41-22) 338.83.38

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## PATENT COOPERATION TREATY

PCT

NOTIFICATION OF THE RECORDING  
OF A CHANGE(PCT Rule 92bis.1 and  
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

NATH, Gary, M.  
Nath & Associates  
6th floor  
1030 15th Street, N.W.  
Washington, DC 20005-1503  
ETATS-UNIS D'AMERIQUE

|   |  |
|---|--|
| Date of mailing (day/month/year)<br>19 February 2001 (19.02.01) | IMPORTANT NOTIFICATION   |
| Applicant's or agent's file reference<br>82201-PC               |  |
| International application No.<br>PCT/US99/20649                 | International filing date (day/month/year)<br>10 September 1999 (10.09.99) |

## 1. The following indications appeared on record concerning:

☒ the applicant ☐ the inventor ☐ the agent ☐ the common representative

## Name and Address

CHOI, Jong, Uk  
KIM, Jong Won  
CHO, Jung Suck  
LEE, Han Ho

## State of Nationality

KR

## State of Residence

KR

Telephone No.

Facsimile No.

Teleprinter No.

## 2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☒ the person ☒ the name ☒ the address ☐ the nationality ☐ the residence

## Name and Address

MARKANY INC.  
151-11 Ssanglim-dong  
Chung-gu  
Seoul, 100-400  
Republic of Korea

## State of Nationality

KR

## State of Residence

KR

Telephone No.

Facsimile No.

Teleprinter No.

## 3. Further observations, if necessary:

**The above-mentioned applicants are to be considered as applicants/inventors for US only, since they assigned their rights for all designated States except US to a new applicant as indicated below.**

## 4. A copy of this notification has been sent to:

☒ the receiving Office ☐ the designated Offices concerned  
☐ the International Searching Authority ☒ the elected Offices concerned  
☒ the International Preliminary Examining Authority ☐ other:

The International Bureau of WIPO  
34, chemin des Colombettes  
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

Dominique DELMAS

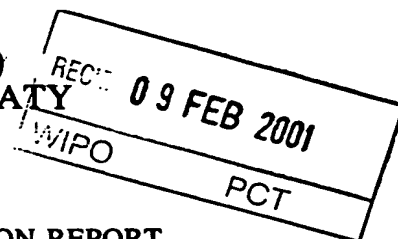
Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)



|   |  |   |
|---|--|---|
| Applicant's or agent's file reference<br>NONE   | FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416) |   |
| International application No.<br>PCT/US99/20649   | International filing date (day/month/year)<br>10 SEPTEMBER 1999  | Priority date (day/month/year)<br>10 SEPTEMBER 1998 |
| International Patent Classification (IPC) or national classification and IPC<br>IPC(7): H04L 9/00 and US Cl.: 382/100 |  |   |
| Applicant<br>CHOI, JONG UK  |  |   |

- This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
- This REPORT consists of a total of 5 sheets.  
☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority. (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).  
 These annexes consist of a total of 0 sheets.
- This report contains indications relating to the following items:
  - ☒ Basis of the report
  - ☐ Priority
  - ☐ Non-establishment of report with regard to novelty, inventive step or industrial applicability
  - ☐ Lack of unity of invention
  - ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
  - ☐ Certain documents cited
  - ☐ Certain defects in the international application
  - ☐ Certain observations on the international application

|  |   |
|--|---|
| Date of submission of the demand<br><br>07 APRIL 2000  | Date of completion of this report<br><br>10 JANUARY 2001  |
| Name and mailing address of the IPEA/US<br>Commissioner of Patents and Trademarks<br>Box PCT<br>Washington, D.C. 20231<br><br>Facsimile No. (703) 305-3230 | Authorized officer<br><br>GAIL HAYES <i>James R. Matthews</i><br><br>Telephone No. (703) 308-4562 |

**I. Basis of the report****1. With regard to the elements of the international application:\***☒ the international application as originally filed☒ the description:

pages 1-21 , as originally filed  
pages NONE , filed with the demand  
pages NONE , filed with the letter of \_\_\_\_\_

☒ the claims:

pages 22-26 , as originally filed  
pages NONE , as amended (together with any statement) under Article 19  
pages NONE , filed with the demand  
pages NONE , filed with the letter of \_\_\_\_\_

☒ the drawings:

pages 1-6 , as originally filed  
pages NONE , filed with the demand  
pages NONE , filed with the letter of \_\_\_\_\_

☒ the sequence listing part of the

description: NONE , as originally filed  
pages NONE , filed with the demand  
pages NONE , filed with the letter of \_\_\_\_\_

**2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.**

These elements were available or furnished to this Authority in the following language \_\_\_\_\_ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).  
☐ the language of publication of the international application (under Rule 48.3(b)).  
☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

**3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international**

- ☐ contained in the international application in printed form.  
☐ filed together with the international application in computer readable form.  
☐ furnished subsequently to this Authority in written form.  
☐ furnished subsequently to this Authority in computer readable form.  
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.  
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

**4. ☒ The amendments have resulted in the cancellation of:**

☒ the description, pages NONE  
☒ the claims, Nos. NONE  
☒ the drawings, sheets/fig NONE

**5. ☐ This report has been drawn as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).\*\***

\* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

\*\*Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US99/20649

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement****1. statement**

|                               |        |             |     |
|-------------------------------|--------|-------------|-----|
| Novelty (N)                   | Claims | <u>1-20</u> | YES |
|                               | Claims | <u>NONE</u> | NO  |
| Inventive Step (IS)           | Claims | <u>NONE</u> | YES |
|                               | Claims | <u>1-20</u> | NO  |
| Industrial Applicability (IA) | Claims | <u>1-20</u> | YES |
|                               | Claims | <u>NONE</u> | NO  |

**2. citations and explanations (Rule 70.7)**

Claims 1-20 lack an inventive step under PCT Article 33(3) as being obvious over Wei, Qin, and Fu Perceptual Digital Watermark of Images Using Wavelet Transform (98) in view of Tang and AOKI A DCT-based Coding of Images In Watermarking (97).

In claim 1 applicant recites a method for watermarking a digital image, which first transforms the digital image using a wavelet transform (WT), transforms the watermark using a discrete cosine transform (DCT) and integrating the DCT with the WT to generate a watermark-embedded image.

Wei et. al. teach transforming an NxN digital image using a WT and then embedding the watermark, using just-noticeable difference in the wavelet domain (see abstract and Figure 2). Such images are robust against attack (abstract). Wei et. al. do not teach DFT the watermark before embedding.

Tang and AOKI teach the embedding of DFT watermarks. This allows the spread of the watermark to all part of the the image (holographic spread), thus those skilled in the art would recognize that a weighted average of the DFT of the water and the WT of the digital image (integrated over the transformed domain) would provide more protection than the teaching of Wei using straight embedding into the wavelet domain as the watermark is spread throughout the wavelet domain before weighting (integration).

In claim 2 applicant recite the method of claim 1 with the additional limitation that the resulting image is inverse wavelet transformed.

Wei et. al. teach taking the inverse WT of the results. Combining the teachings of Wei et. al. and Tang et. al. as in claim 1 would then require one skilled in the art to take the inverse WT of the weighted results.

In claim 3, applicant recites the method of claim 1 with the further limitation that the DCT watermark is further transformed (Continued on Supplemental Sheet.)

**Supplemental Box**

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: Boxes I - VIII

Sheet 10

V. 2. REASONED STATEMENTS - CITATIONS AND EXPLANATIONS (Continued):  
with an m-level wavelet transform before being integrated with the WT of the image.

Wei et. al. modified by Tang et. al. do not teach this further wavelet transform of the DCT, however, those skilled in the art would recognize that the use of an m-level wavelet transform in addition to the DFT of the watermark, produces not only a watermark spread over the entire wavelet domain, but also a result that is localized in the the wavelet domain thus balancing the averaging of the DCT and the WT in the wavelet domain.

In claims 4 and 5, applicant implements wavelet transforms in claims 1 and 3 using filter bank method.

The modivation to use filter banks method with regards to digital signal processing is that such a method is necessary when using digital data.

In claim 6, applicant recites a method of claim 1 wherein the obtaining the image integration with a watermark, the wavelet scale parameter alpha is used to adjust the spacing between the original image and the watermark.

The modivation for using the wavelet scale parameter alpha for performing the averaging of the two functions of claim 1, would have been that it is a free parameter and the spacing between the original image and watermark would represent a unambiguous measure over the wavelet domain.

In claim 7, applicant recites the method of claim 1 with the further restriction the the images and watermarks are black and white.

Wei et. al. do not discuss the modifications necessary for color images and thus restrict their images to black and white.

Claims 8-11, is a system claim for implementing claims 1, 7, 3, and 4 lack the same inventive step.

In claim 12 applicant has the same limitations as claim 1 except that the digital images being transformed are in color.

Color images as opposed to black and white transfer more information to the user (contrast black and white TV with color), and thus one skilled in the art would be modivated to extend the teaching of Wei et. al. and Tang et. al. to color images.

In claim 13 applicant claims RGB mode to YIQ mode using a conversion matrix.

RGB and YIQ are standard mode for color image presentation adopted by the National Television System Committee (NTSC), back in the 1950 for color TV formats. As standards, one would be modivated to adopt standards for modivation of claim 12.

Claims 14-17, are implimentations of claims 1, 3 and 5 to color images using the RGB and YIQ standards and are rejected in view of the same prior art. Note claims 16 and 17 are identical.

Claim 18 provides for both black and white as well as color and is a combination of the above two schemes. Again the advantage of having a system capable of doing both black and white as well as color is well know (note when the color TV standard was adopted in the 50s, it was made compatible with black and white).

Claims 19 and 20 recite the method of compatibility for black and white and color digital images using the standards RGB and YIQ and wavelet and m-level wavelet transforms. The modivation for implimentation of m-level transforms in leu of WT was discussed above. This same technique was used for black and white and color TVs in the 50's. As the technology is well developed from the TV art, one skilled in the art would be modivated to apply it in the teachings of Wei et. al. and Tang. et. al. Claims 19 and 20 lack the same inventive step as 1 and 12 above on the basis of the prior art.

## NEW CITATIONS

Z. WEI, P. QUIN and Y. FU, Perceptual Digital Watermark of Images Using Wavelet Transform, IEEETransaction of Consumer Electronics, Vol 44, No. 4, November 1998

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US99/20649

**Supplemental Box**

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: Boxes I - VIII

Sheet 11

W. TANG and Y. AOKI, A DCT-based Coding of Images In Watermarking, Information Communication and Signal Processing, September 1997

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US99/20649

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : H04L 9/00

US CL : 382/100

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 382/100

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Please See Extra Sheet.

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

Dialog, STN. West, IEEE proceedings

(same search as above)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages   | Relevant to claim No. |
|-----------|--|-----------------------|
| Y         | PIVA, A. et al DCT-based Watermark Recovering Without Resorting to the Uncorrupted Original Image, IEEE 1997, pages 520-523  | 1-20                  |
| Y         | RUANAIDH, J. et al Rotation, Scale and Translation Invariant Digital Image Watermarking IEEE 1997 pages 536-539              | 1-20                  |
| Y         | WOLFGANG, R. et al A Watermark For Digital Images IEEE 1996 proc. International Conference on Image Processing pages 219-222 | 1-20                  |
| Y         | VAN SCHYNDEL, R. et al A Digital Watermark IEEE Proc. ICIP-1994 Vol 2 pages 86-90  | 1-20                  |

☒ Further documents are listed in the continuation of Box C.☐ See patent family annex.

|   |  |
|---|--|
| * Special categories of cited documents:  | *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention  |
| *A* document defining the general state of the art which is not considered to be of particular relevance  | *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone   |
| *B* earlier document published on or after the international filing date  | *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art |
| *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) | *A* document member of the same patent family  |
| *O* document referring to an oral disclosure, use, exhibition or other means  |  |
| *P* document published prior to the international filing date but later than the priority date claimed  |  |

Date of the actual completion of the international search

28 DECEMBER 1999

Date of mailing of the international search report

11 FEB 2000

Name and mailing address of the ISA/US  
Commissioner of Patents and Trademarks  
Box PCT  
Washington, D.C. 20231

Facsimile No. (703) 305-3230

Authorized officer

Gail Hayes

Telephone No. (703) 308-4562



# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US99/20649

| C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT |   |                       |
|---|---|-----------------------|
| Category*   | Citation of document, with indication, where appropriate, of the relevant passages  | Relevant to claim No. |
| Y   | TANG, WEILI A DCT-based Coding of Images In Watermarking IEEE Information, Communications and Signal Processing, Sept 1997  | 1-20                  |
| Y   | WONG, K. Adaptive Water Marking, IEEE Transactions on Consumer Electronics, Vol 43 No 4 November 1997   | 1-20                  |
| Y   | US 4,564,915 A (EVANS et al) 14 January 1986 col 9 and 10   | 12-20                 |
| Y   | HUBBARD, BARBARA The World According to Wavelets, A. K. Peters, Ltd 1996 pages 138-152  | 1-20                  |
| Y   | SCHNEIER, BRUCE Applied Cryptography 2e John Wiley 1996 pages 9-10  | 1-20                  |
| Y   | INOUE, H. et al A Digital Watermark Based on the Wavelet Transform and its Robustness on Image Compression ICIP 98 Proc. 1998 International Conference on Image Processing Jan 1998 pages 391-395 | 1-20                  |
| Y   | KUNDUR, D et al Digital Watermarking Using Multiresolution Wavelet Decomposition ICIP 98 Proc. 1998 International Conference on Image Processing Vol 5 pages 2969-2972                            | 1-20                  |

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US99/20649

## B. FIELDS SEARCHED

Documentation other than minimum documentation that are included in the fields searched:

EIC search

(Watermark digital fingerprinting or steganography or embedded images)+ (Discrete Cosine Transform or DCT) and  
(Wavelet or Wavelet transform or WT) + RGB/YIQ

## PATENT COOPERATION TREATY

## PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

REC'D 23 MAR 2001

WIPO

PCT

|   |   |   |
|---|---|---|
| Applicant's or agent's file reference<br>NONE   | FOR FURTHER ACTION  | See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416) |
| International application No.<br>PCT/US99/20649   | International filing date (day/month/year)<br>10 SEPTEMBER 1999 | Priority date (day/month/year)<br>10 SEPTEMBER 1998   |
| International Patent Classification (IPC) or national classification and IPC<br>IPC(7): H04L 9/00 and US Cl.: 382/100 |   |   |
| Applicant<br>CHOI, JONG UK  |   |   |

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 3 sheets.

☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority. (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 0 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of report with regard to novelty, inventive step or industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

CORRECTED  
VERSION

|  |   |
|--|---|
| Date of submission of the demand<br>07 APRIL 2000  | Date of completion of this report<br>10 JANUARY 2001      |
| Name and mailing address of the IPEA/US<br>Commissioner of Patents and Trademarks<br>Box PCT<br>Washington, D.C. 20231 | Authorized officer<br>GAIL HAYES <i>James R. Matthews</i> |
| Facsimile No. (703) 305-3230   | Telephone No. (703) 308-4562                              |

**I. Basis of the report****1. With regard to the elements of the international application:\***

- ☒ the international application as originally filed
- ☒ the description:  
pages 1-21 , as originally filed  
pages NONE , filed with the demand  
pages NONE , filed with the letter of \_\_\_\_\_
- ☒ the claims:  
pages 22-26 , as originally filed  
pages NONE , as amended (together with any statement) under Article 19  
pages NONE , filed with the demand  
pages NONE , filed with the letter of \_\_\_\_\_
- ☒ the drawings:  
pages 1-6 , as originally filed  
pages NONE , filed with the demand  
pages NONE , filed with the letter of \_\_\_\_\_
- ☒ the sequence listing part of the  
description: NONE , as originally filed  
pages NONE , filed with the demand  
pages NONE , filed with the letter of \_\_\_\_\_

**2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.**

These elements were available or furnished to this Authority in the following language \_\_\_\_\_ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

**3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international**

- ☐ contained in the international application in printed form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

**4. ☒ The amendments have resulted in the cancellation of:**

- ☒ the description, pages NONE
- ☒ the claims, Nos. 21
- ☒ the drawings, sheets/fig NONE

**5. ☐ This report has been drawn as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).\*\***

**\* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).**

**\*\*Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.**

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US99/20649

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement****1. statement**

Novelty (N)

Claims 1-20 YESClaims NONE NO

Inventive Step (IS)

Claims 1-20 YESClaims NONE NO

Industrial Applicability (IA)

Claims 1-20 YESClaims NONE NO**2. citations and explanations (Rule 70.7)**

Claims 1-20 meet the criteria set out in PCT Article 33(2)-(4), because the prior art does not teach or fairly suggest the concept of combining discrete Fourier transforms with wavelets as a means to obtain a robust watermark, but at the same time imprecitable to viewer.

\_\_\_\_\_ NEW CITATIONS \_\_\_\_\_

Z. WEI, P. QUIN and Y. FU, Perceptual Digital Watermark of Images Using Wavelet Transform, IEEE Transaction of Consumer Electronics, Vol 44, No. 4, November 1998

W. TANG and Y. AOKI, A DCT-based Coding of Images In Watermarking, Information Communication and Signal Processing, September 1997

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